PROGRESS REPORT - YEAR 2 - 1983
WORK PLAN - YEAR 3 - 1984

COASTAL GRIZZLY RESEARCH PROJECT

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A Cooperative Project Between the Ministries of
Environment and Forests

Wildlife Branch
Ministry of Environment
Victoria, B.C.

Research Branch
Ministry of Forests
Victoria, B.C.

Wildlife Working Report No. WR-2
Wildlife Habitat Research Report No. WHR-10

First Printed October 1984
Revised October 1985

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BACKGROUND

The coastal forests of mainland British Columbia support some of the highest grizzly bear densities in the province. Apparently, logging in these forests results in declines in grizzly numbers (Archibald 1983). The operative factor in these population declines is unknown. To achieve management objectives established by the Ministry of Environment, Fish and Wildlife Branch, grizzly numbers must be maintained in coastal forests. To do so, the historical pattern of logging coastal forests followed by declines in grizzly bear numbers must be broken.

A research project designed to provide the information necessary to address the long-term welfare of coastal grizzlies was initiated in April, 1982. This project is cooperatively funded and administered by the Ministries of Environment and Forests. Project planning documents (Archibald and Hamilton 1982; Archibald 1983) and a first progress report (Hamilton 1984) have been previously prepared.

This report summarizes project progress for year 2 of a five-year-study and outlines work objectives for year 3.

We would like to acknowledge the following forest companies of B. C. for their project support and assistance: British Columbia Forest Products, Crown Forest (formerly Crown Zellerbach), Domans, and MacMillan Bloedel. Valuable field assistance was provided by regional staff from the Ministries of Environment and Forests, as well as volunteer assistants from UBC. We also wish to acknowledge the substantial field contribution made by Andy Derocher. The first draft of this report was competently typed by Lynda Adams to a completely unrealistic deadline; subsequent drafts were ably typed by Darla Cooper.

OBJECTIVES

Project objectives are:

1) to identify seasonal habitat requirements of coastal grizzlies

2) to determine the impacts of timber harvest on coastal grizzly bears in the absence of hunting

3) to determine baseline population characteristics of coastal grizzlies.

Data collection during the 1983 field season focused primarily on objective 1 above. Data collection during the 1984 field season will focus on objective 2.

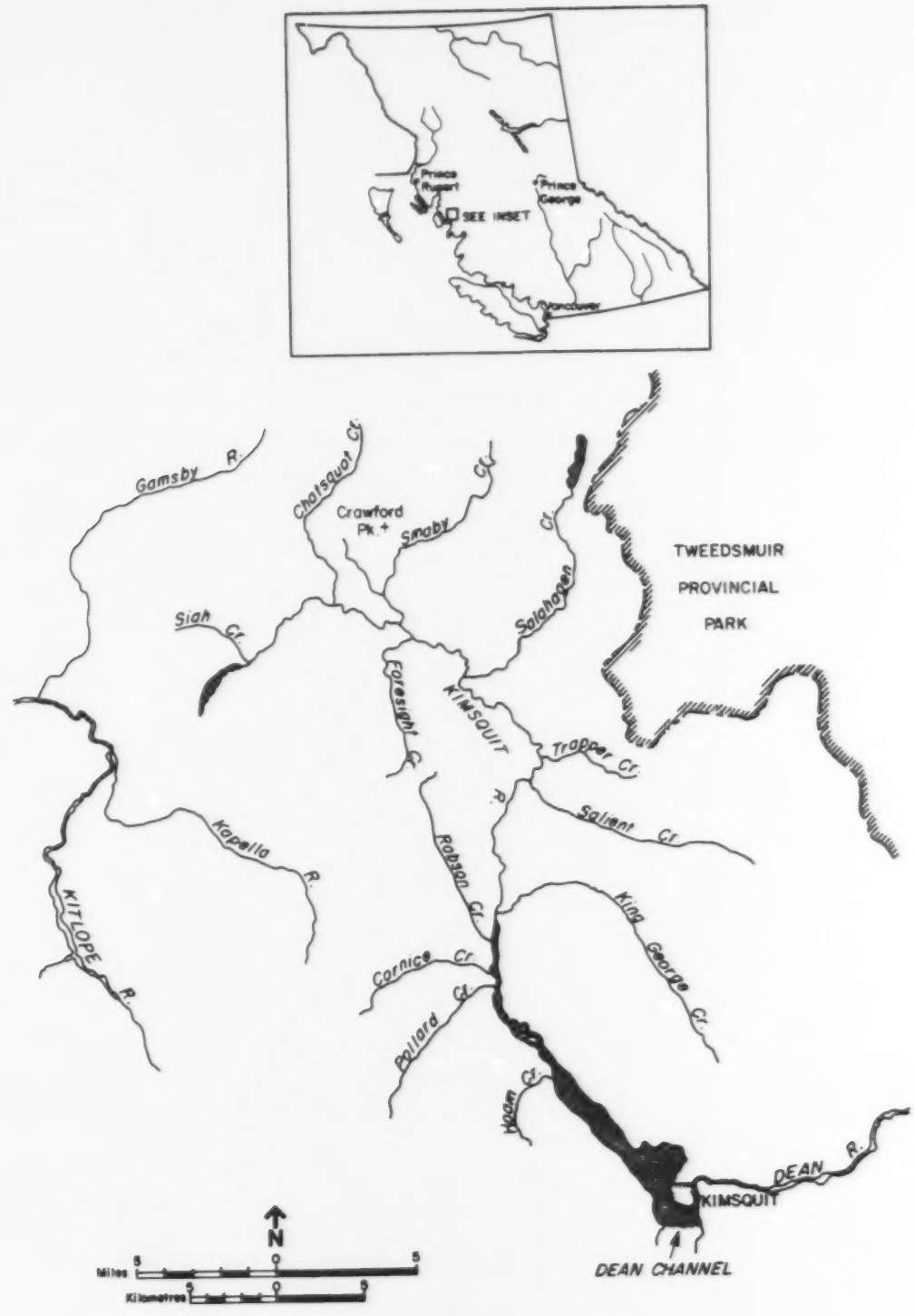

Figure 1. LOCATION OF STUDY AREA

STUDY AREA

The study is located in the Kimsquit watershed, located approximately 500 km northwest of Vancouver (Fig. 1). A detailed description of the area is provided by Hamilton (1983).

The Kimsquit was partitioned into intensive and extensive areas of study based on the opportunities for data collection. The intensive study area is located in the southern portion of the valley and roughly follows the boundary of the CWHh3 outlined in Figure 2. Ground access through this area is provided by 25 km of logging roads and the navigable river. The historical and current logging activity in this area is outlined in Hamilton (1983). The remainder of the watershed is the extensive area of study. There has been no development in the area.

PROGRESS REPORT - YEAR 2

Materials and Methods

A helicopter trapline was established along the floodplain of the Kimsquit, outside of the intensive study area. Grizzlies were captured, immobilized, and fitted with radio transmitters as described by Hamilton (1983).

Locations of all radio-collared bears were determined weekly from aircraft. Aerial relocation data for all grizzlies were keypunched and computer-filed. Data analysis by a modification of Harestad's (1981) program provided information on movements, home range sizes, and centres of activity.

Radio-transmittered grizzlies in the intensive study area were monitored daily with a vehicle-mounted receiving system (Archibald et al. 1984). Ground relocation data were keypunched and analysed using a program developed by Page (1983). Verified ground data will be pooled with aerial relocations and visual sightings, to develop seasonal home ranges and centres of activity for grizzlies in the intensive study area.

The habitat classification for the Kimsquit, detailed in Yole et al. (1982) and discussed by Hamilton (1983), was expanded in 1983. The CWHh3 variant was investigated by Banner et al. (in prep.) and the remainder of the study area (Fig. 2) by Clement (1984 a, b). Mapping strategy was to pretype on aerial photographs, then conduct ground reconnaissance.

Two map sheets at 1:20 000 were selected to determine the usefulness of the Computer Aided Planning Assessment and Map Production (CAPAMP) process for wildlife habitat interpretations. The map sheets to be digitized included over

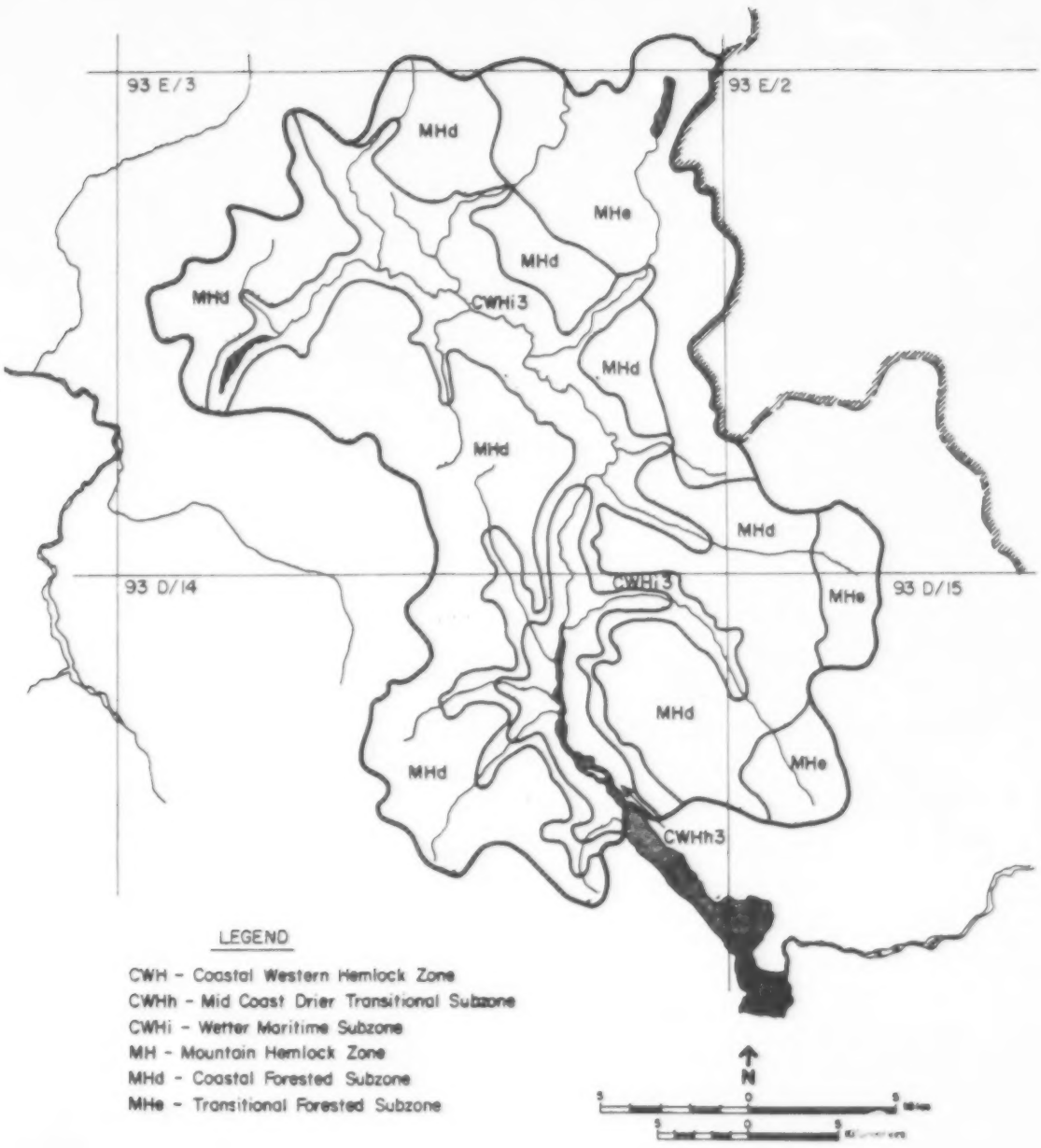

Figure 2. MAP OF FORESTED BIOGEOCLIMATIC SUBZONES OF THE KIMSQUIT RIVER VALLEY

95% of the relocations of the two intensively monitored adult female grizzlies. As well, the majority of the CWHh3 variant occurred on these two map sheets.

Site investigations in areas of recent grizzly activity were done to identify and evaluate those habitat characteristics that are important in determining movements between specific habitat units and use of these units. Characteristics were measured at each site if they were biologically relevant to grizzlies and measurable to a desired level of precision.

Sites identified for investigation were selected on the basis of ground relocation of radio-collared bears, through direct observation of grizzlies, or were located in known areas of traditional grizzly use. The UTM coordinates of radio-relocated bears were transferred daily to an air photo mosaic and relocations having an uncertainty area of less than 1 ha were selected for investigation the following day. The site was not visited if the bear remained in the same area. Colour air photographs (1:20 000) were used to navigate to the centroid of the relocation polygon. The area was then searched for evidence of recent bear activity. When bear activity other than marking was encountered, the exact location of the site, confirmation of grizzly activity, and date of use were needed before a site investigation form (Appendix A) was completed.

Data from site investigations were listed and sorted by activity in one-way and two-way frequency tables. Standard statistics were determined for numerical characteristics. Synthesis tables for plant species were produced using the VEGSORT program (Medinger et al. 1983).

Radio-transmittered grizzlies were monitored by fixed-wing aircraft until denning. A helicopter survey was then conducted to determine den locations. Dens were marked with weighted flagging tape dropped from the helicopter and positions marked on 1:50 000 topographic maps. We visited some dens after emergence to identify criteria that grizzlies might use to select den sites.

Results and Discussion

Eight grizzlies and nine black bears were captured during a 36 h helicopter (Hughes 500C) contract. Table 1 summarizes all grizzly capture and aerial monitoring data to January 1, 1984. Records for all bears captured in 1984 are presented in Appendix B.

Twenty-eight surveys were flown in 1983 adding up to 4.7 h of helicopter and 36.7 h of fixed-wing time. Transmitter-equipped animals were located 174 times (excluding cubs with females). Of these, 25 (approximately 15%) were visual observations.

The 1982 progress report (Hamilton 1984) mistakenly suggests that bear 28 (a yearling male) separated from his mother (bear 8) in the fall of 1982. In fact, he had dropped his ear tag transmitter. The unit was still functioning when recovered May 7, 1983.

Several observations were made of breeding pairs (Table 2). Breeding activity apparently began as early as May 19, when bear 47 was separated from an adult male and darted, and continued through until late June.

The extent of interwatershed movements was further investigated in 1983. Table 3 summarizes data collected on these movements. From these data, coastal grizzly populations apparently cannot be defined on a single watershed basis.

Home range data are summarized in Table 4. Average home range size (for 100% of the locations) for four adult females was 102 km^2.

The 1983 movements of bear 05 were again much more extensive than those of the other collared adult females. In 1982, we did not observe her in salmon areas; in 1983, however, she was located in salmon areas on three of six weekly flights from August 25 to October 6. If the home range mean for adult females was calculated without bear 05, it became 55 km^2. For three subadult males, the average was 338 km^2 and for two adult males, it was 353 km^2.

Three mapping projects were completed in 1984. The estuary was mapped at 1:2500. A report detailing the estuary classification strategy along with descriptions of each habitat type was prepared (Clement 1984a). The CWHh3 variant (Fig. 2) was mapped at 1:20 000. Approximately 60% of the 427 mapped polygon units were visited. Banner et al. (in prep.) will detail the classification strategy and describe each association. Table 5 outlines the ecosystem associations and seral variations developed for the CWHh3 variant by Banner et al. (in prep.).

The remainder of the study area (extensive area) was also mapped at 1:20 000 and is described in Clement (1984b). Due to the large size of the extensive area (14 x 1:20 000 map sheets) and the difficulty and expense of access, a much smaller proportion of the map polygons were visited on the ground.

No products have been obtained from the CAPAMP process yet. Digitization of polygon units is nearly complete. This process should allow for rapid use/availability analyses and derivative maps for each grizzly activity.

A total of 234 sites were located, verified, and described between May 25 and October 20, yielding a total of 408 records of activity. Table 6 outlines the numbers of the individual activities, sorted by known and unknown grizzly.

The seasonal definitions outlined in Archibald and Hamilton (1982) were revised as indicated in Table 7. Table 8 outlines the activity data collected by season. This table does not provide an accurate picture of frequency of activity by season for a number of reasons, including:

1) no activity was recorded during season one, whereas seasons two and three had only limited sampling;

2) verification criteria for date of use were relaxed for mark trees and permanent mark trails save for the assignment "this year";

3) travel activity was under-represented in seasons one through four as travel sampling criteria were not established until early July.

Habitat units (ecosystem associations or association variations) from Table 5 were assigned to each activity site. Since the complete classification was not available until mid-July, habitat assignments for the first four seasons were checked before coding, and re-assigned as necessary on the basis of the full plant species list, the VEGSORT output, the soil information, and the location. Comparison of site habitat assignments and map polygon labels will be done to check for discrepancies. Differences between the two could be due to errors of classification or to bear use of units ("inclusions") too small to be mapped. Where discrepancies occur, errors of classification will be checked by again examining the full plant species lists, the VEGSORT output, the soil information, and the location.

Table 9 summarizes the activity records by ecosystem association. By comparing Table 9 with the classification of the intensive area presented in Table 5, it appears that no grizzly activity occurred in some of the ecosystems of the CWHh3 variant. No activities were investigated in the CWHi3 variant or the MH zone. In addition, 72% of the activity records were assigned to the h306 ecosystem association. A number of factors may have contributed to the pattern recorded, the most likely being:

1) some habitats may not be used by grizzlies in the lower Kimsquit (or the units may not occur there);

2) some habitats may have been used only during seasons one, two, and three; and,

3) some habitats may be inside ground telemetry "shadows" (i.e. areas where accurate and precise ground telemetry is difficult or impossible).

Reliability of monitoring the habitat use pattern will be increased by improving the ground telemetry system, beginning systematic sampling in early April, and, perhaps, by collaring other grizzlies resident in the lower Kimsquit. Increased reliability will allow more meaningful use/availability analyses.

Data on bedding were recorded at 106 sites. Average measurements for 75 of these beds were: length 109 cm, width 95 cm, depth 25 cm. It was common to find more than one bed at an activity site, often of different ages. Almost all beds encountered were excavated in loose mineral soil. It appeared that, by digging a slight depression after clearing away surface litter and humus, the bears had a comfortable and cool place to sleep.

In very warm weather, bears seem to bed in cool sites. During extremely hot weather in July, both collared adult females bedded in an old log jam that had regenerated to predominantly alder tree cover. Beds were found approximately 1.5 m below the surface of the log jam, under large rotting logs. The temperature was estimated to be 10°C cooler at these sites than the ambient temperature. Other examples of bedding in cool sites during hot weather were recorded including beds located at the base of "rubbly" colluvial slopes in areas of cold air drainage and, more commonly, in ditch-like dry run-off channels. At the latter sites, one edge of the ditch would often be excavated to form the back "wall" of the bed depression.

Possible selection for mature coniferous forest during heavy rain was also observed. A number of beds were located at the base of large conifers where the low overhanging branches prevented most of the rain from reaching the forest floor.

A total of 41 mark trees at 40 sites, and 31 mark trails were located and sampled during 1983. As mentioned, only those trees and trails used during 1983 were sampled.

For mark trees, species, DBH, maximum height marked, and age were measured and the nature of the marking described. Some trees were identified as "scratch" trees where claw marks and sometimes tooth impressions were obvious. Other trees were called "rub" trees and had little or no scratching of the bark. Summary statistics of all mark trees by species are given in Table 10.

Further investigations into the frequency, seasonal timing, and site characteristics of marking behaviour are required.

Where verified feeding activity was encountered, plant species used for food were identified and listed in order of volume consumed. Vegetative and generative phenology was also recorded. For berry species and for salmon, approximate measures of abundance were also determined. The data on phenology and berry abundance will be pooled with similar data collected by the ecological mapping crews in the intensive area to help quantify grizzly plant availability by season and habitat type. These analyses have yet to be completed.

For some food species, verification of use was often difficult, particularly those that were grazed (e.g. sedges, grasses, horsetails, ladyfern). With this lack of verification, the late spring start-up, and the limitations of the ground telemetry, the "seasonal" pattern of food selection observed is incomplete. Analysis of over 100 known date, known grizzly scats (Dibbs and Cofske, in prep.) will supplement the activity site data.

Table 11 summarizes verified grizzly bear food plants recorded in the lower Kimsquit. Frequency of recorded use of foods during site investigations is given in Table 12. Table 13 is a preliminary model of seasonal habitat use.

Food-related data collection will be expanded in 1984 to include more accurate measures of biomass and "quality."

Preliminary analysis has also been conducted on the following site investigation data: grizzly activity by soil parameters, grizzly activity by visual cover and ease of movement, distance from grizzly activity to salmon, human disturbance, openings and cover, as well as grizzly activity by vegetative strata coverage. These data sets will be supplemented in 1984 and discussed in future progress reports.

Multivariate statistics will be used in an attempt to build a model of grizzly seasonal habitat use. Site variables to be used in generating the model are currently being selected. A combination of continuous and categorical variables precludes the use of conventional analyses. This analytical problem is being addressed by statisticians from Research Branch, Ministry of Forests.

During the winter of 1982/83, aerial surveys were conducted on November 18, December 9, and March 3. On December 9, den sites of five bears (bears 01, 02, 05, 08, and 25) were marked from a helicopter. One of these dens, that of bear No. 5, was visited on June 13, 1983 and is described in Appendix C.

During the winter of 1983/84, aerial surveys were also conducted: November 17, February 2, and March 16. Five den sites were marked on February 2 by dropping brightly coloured "hoola hoops" from the helicopter over trees near the strongest telemetry signals. Beacon transmitters (Hamilton 1983) were attached to these hoops to allow rapid relocation of these sites. A preliminary summary of den site characteristics is given in Table 14.

Table 1. Captures and monitoring data for grizzly bears in the Kimsquit watershed, 1982 and 1983.

Bear No.[a]	Bear name	Sex	1983 age	Date 1st captured	No. of Locations 1982	No. of Locations 1983	Total	Comments
01	Jason	M	13	07/05/82	20	2	22	last located at Kimsquit Lake on 11/04/83
02	Stanley	M	3	09/05/82	4	3	7	dropped radio collar between 09/12/82 and 11/05/83-recaptured and fit with ear tag transmitter on 11/05/83-transmitter stationary since 04/08/83
05	Sandy	F	11	11/05/82	14	22	36	expected to produce cubs in 1983 - did not - "high elevation bear"
08	Marsha	F	14	17/05/82	20	26	46	separated from 2 x 2 yr old cubs by 21/06/83-believed to be accompanied by male 21/06/83-intensive habitat use/movement data recorded in 1983
09	Billy[b]	M	2	17/05/82	20	8	28	separated from mother (bear #8) by 21/06/83
11	Jenny	F	2	17/05/82	0	8	8	equipped with loose radio collar on 16/05/83-collar stationary on 30/06, ground checked on 27/07-bear dead from unknown causes.
24	Colleen[b]	F	2	03/07/82	12	8	20	separated from mother (bear #25) by 21/06/83-resighted (ground) on 05/08 (alone)-ear tag transmitter not functioning by 18/11/82
25	Shelly	F	17	08/07/82	12	26	38	separated from 2 x 2 yr old cubs on 21/06/83-accompanied by male on 21/06/83 for several days-intensive habitat use/movement data recorded in 1983
26	Louis	M	--	09/07/82	0	0	0	died as a result of capture on 09/07/82
27	Jamie[b]	M	2	12/07/82	12	8	20	separated from mother (bear #25) by 21/06/83-ear tag transmitter ceased functioning by 27/10/82
28	Stuart[b]	M	2	15/07/82	20	8	28	separated from mother by 21/06/83 - ear tag transmitter dropped by 28/09/82
34	Earl	M	--	31/08/82	4	0	4	shot by resident hunter on 14/10/82 at Dean River
38	Caesar	M	17	08/05/83	0	5	5	recaptured on 13/05/83-signal last heard on 16/06/83 - accompanied by bear #47 on 02/06/83
41	Andy	M	3	18/05/83	0	21	21	suspected sibling of bear #46
44	Sonny	M	13	13/05/83	0	21	21	accompanied by female (unknown) on 26/05/83
46	Amos	M	3	16/05/83	0	22	22	suspected sibling of bear #41
47	Louise	F	11	19/05/83	0	20	20	with bear #38 on 02/06/83 - gap in movement data from 30/06/83 to 21/07/83

[a] 17 Grizzlies Captured:
3 Known Mortalities (Bear #'s 11(natural, Appendix D), 26(capture), 34(hunter)).
7 Transmitter failures (2 from same bear) or losses.
7 Active transmitters (Bear #09 never equipped with transmitter).

[b] Numerous visuals of lone 2-1/2-year-olds as well as consistent sightings of a sibling pair were recorded in 1983 in the lower Kimsquit Valley.

Table 2. Observations of breeding pairs of Kimsquit grizzly bears, 1983.

Date	Bears	Location	Habitat
May 19	Bear 47 and Adult M (bear 38?)	near mouth of Chatsquot Creek	Avalanche chute
May 26	Bear 44 and Adult F (unknown)	between Chatsquot and Siah Creeks	Snow patch on avalanche chute
June 2[a] and June 16	Bear 38 and Bear 47	near mouth of Chatsquot Creek	Avalanche chute
June 21	Bear 08 Bear 25 and Adult M (Bear 01?)	Lower Kimsquit	Mature seral cottonwood forest

[a] aerial locations without visual confirmation

Table 3. Interwatershed movement of grizzlies recorded in the 1983 field season.

Bear No.	Sex/age class	Second watershed (from Kimsquit to —)
02	Subadult male	Dean River
05	Adult female	Sakumtha River
34	Adult male	Dean River
41	Subadult male	Kapella River
44	Adult male	Kitlope River
46	Subadult male	Kitlope River

Table 4. Home range (HR) data summary for radio-collared Kimsquit grizzly bears, based on combined 1982 and 1983 data.

Bear No.	Bear name	No. of locations	Max. straight line distance between consecutive weekly locations (km)	Estimated HR size (km^2) 100%	90%	50%	Harmonic mean distance deviation (m)
5	Sandy	36	15.4	245	157	40	3568
8	Marsha	49	10.6	60	35	3	1722
25	Shelly	41	5.2	35	20	3	1598
47	Louise	20	5.3	69	41	17	2680
11	Jenny	9	9.0	20	19	0.3	1850
1	Jason	23	34.8	393	184	5	2824
44	Sonny	22	23.1	312	178	21	3317
41	Andy	22	13.6	176	66	17	2640
46	Amos	22	18.6	549	226	18	2590
2	Stanley	10	24.9	290	251	0.01	2543

Table 5. Ecosystem associations of the CWHh3 variant in the Kimsquit watershed.[a]

Ecosystem association	Association name	Variations
h301	Zonal hemlock-(Douglas-fir) -Vaccinium - moss	1. Herb 2. amabilis fir-Rhytidiopsis robusta 3. Nudum
h302	Dry Douglas-fir - pine - salal - Pleurozium - lichen	1. Vaccinium
h303	Submesic - hemlock - moss	1. Douglas-fir - salal 2. Vaccinium
h304	Oak fern - moss	1. Douglas-fir - sword fern 2. Nudum
h305	Devil's club - fern	1. Cottonwood-spruce-salmonberry-devil's club 2. Alder-salmonberry-elderberry 3. Alder-salmonberry-pole sapling 4. Salmonberry-thimbleberry-lady fern-shrub
h306	Floodplain spruce - devil's club	1. Cottonwood-spruce-salmonberry-devil's club 2. Cottonwood-devil's club-salmonberry 3. Cottonwood-alder-salmonberry-devil's club 4. Alder-salmonberry-elderberry 5. Alder-salmonberry-pole sapling 6. Alder-grass 7. Salmonberry-thimbleberry-lady fern-shrub 8. Alder-willow-fireweed-Rhacomitrium-gravel/sandbar pioneer seral complex 9. Cottonwood-alder-twinberry young seral 10. Spruce-cottonwood-thimbleberry-devil's club-pole sapling young seral
h307	Skunk cabbage swamps	
h308	Non-forested wetlands	
h309	Avalanche tracks and rock slides	

[a] Successional stages:

A	non-vegetated or bryoid	E	mature seral
B	herb pioneer seral	F	young climax
C	shrub-seedling pioneer seral	G	mature climax
D	pole-sapling young seral	H	old growth

Table 6. Frequency table of activities[a] for individual grizzly bears, Kimsquit watershed, 1983.

Activity	Marsha	Shelly	Large male	Shelly & Marsha	Siblings (2 1/2 yr)	Shelley & male	Female with COY	Unknown subadult	Unknown grizzly	Total
Bedding	31	22	5	4	2	3	1	1	37	106
Feeding	32	22	3	0	3	6	2	3	30	101
Mark tree	6	0	0	1	0	3	0	0	30	40
Mark trail	6	0	1	1	0	2	0	0	21	31
Travel	33	20	6	2	4	6	4	6	47	128
Other	2	0	0	0	0	0	0	0	0	2
Total	110	64	15	8	9	20	7	10	165	408

[a] based on 234 site investigations

Table 7. Revised definitions of bear seasons and their approximate duration.

Approximate dates	Season	Code	Description
01/04 - 15/04	One	1	Emergence to valley floor leaf flush
16/04 - 30/04	Two	2	Valley floor leaf flush to avalanche chute green-up
01/05 - 15/06	Three	3	Avalanche chute green-up to berry production
16/06 - 31/07	Four	4	Berry production - no salmon
01/08 - 31/08	Five	45	Berry production and salmon availability
01/09 - 15/10	Six	47	Salmon availability - no berries
16/10 - 31/10	Seven	5	Post salmon availability - predenning
01/11 - 31/03	Eight	6	Denning

Table 8. Frequency table of activities per season for Kimsquit grizzlies, 1983.

Activity	Season					
	Two	Three	Four	Five	Six	Seven
Bedding	2	10	8	32	49	5
Feeding	1	18	29	27	23	3
Mark tree	0	9	12	4	13	2
Mark trail	0	8	7	5	9	2
Travel	0	10	27	38	47	6
Other	0	1	1	0	0	0
Total	3	56	84	106	141	18

Table 9. Frequency table of activity by ecosystem association for the Kimsquit grizzlies, 1983.

Activity	Ecosystem association										Cut block
	Estuary	h301	h304	h305	h306	h307	h308	h309	Ditch	Road	
Bedding	1	4	2	12	85	0	0	0	0	1	1
Feeding	5	2	0	10	75	5	2	1	1	0	0
Mark tree	1	3	4	16	16	0	0	0	0	0	0
Mark trail	1	1	4	12	13	0	0	0	0	0	0
Travel	3	2	1	8	103	3	2	1	0	3	2
Other	0	1	0	1	0	0	0	0	0	0	0
Total	11	13	11	59	292	8	4	2	1	4	3

Table 10. Mark tree statistics for the Kimsquit valley, 1983 data.

Species	N	Mean DBH(cm)	Mean age	Mean max. ht. marked (cm)
Populus balsamifera ssp. *trichocarpa*	1	10	-	-
Abies amabilis	22	27	65	209
Thuja plicata	2	16.5	38.5	200
Pseudotsuga menziesii	1	81	-	-
Tsuga heterophylla	4	39	127	195
Picea sitchensis	11	34	71	196

Table 11. Verified food plants of grizzly bears in the Kimsquit valley.

Scientific name	Common name	Parts consumed
Angelica genuflexa	white angelica	roots, stems, leaves
Athyrium felix-femina	ladyfern	pinnae
Carex spp.	sedges	blades
Graminae	grasses	blades
Cornus sericea	red-osier dogwood	berries
Equisetum spp.	horsetail	all?
Heracleum sphondylium	cow's parsnip	all
Lonicera involucrata	twinberry	berries
Lupinus nootkatensis	lupine	roots
Lysichiton americanum	skunk cabbage	roots (some leaves)
Oplopanax horridus	devil's club	leaf, stems, berries
Osmorhiza chilensis	mountain sweet cicely	roots
Ribes bracteosum	stink currant	berries
Rubus spectabilis	salmonberry	shoots, leaves and berries
Sambucus racemosa	red-elderberry	berries
Scirpus microcarpus	smallfruited bulrush	blades
Streptopus roseus	twisted stalk	berries
Vaccinium spp.	blue/huckleberries	berries
Veratrum viride	green false hellebore	stems
Viburnum edule	highbush cranberry	berries

Table 12. Frequency of occurrence of food species recorded during site investigations in the Kimsquit valley, 1983.

Species	Frequency	Percentage
Angelica genuflexa	2	1.0
Athyrium filix-femina	8	5.0
Carex spp.	4	2.5
Cornus sericea	3	2.0
Equisetum spp.	1	0.5
Heracleum sphondylium	5	3.0
Lonicera involucrata	7	4.5
Lupinus nootkatensis	2	1.0
Lysichiton americanum	13	8.0
Oplopanax horridus	30	19.0
Osmorhiza chilensis	7	4.5
Ribes bracteosum	1	0.5
Rubus spectabilis	13	8.0
Sambucus racemosa	9	6.0
Scirpus microcarpus	9	6.0
Vaccinium spp.	4	2.5
Viburnum edule	3	2.0
Insects	4	2.5
Fresh Salmon	25	16.0
Rotten Salmon	8	5.0

Table 13. Preliminary seasonal habitat use model for grizzly bears in the lower Kimsquit valley.

Season	General habitat	Food species
One	Unknown	Unknown
Two	Estuary and ?	Carex spp., Angelica genuflexa, Heracleum sphondylium
Three	Avalanche chutes Forest bogs Riparian areas	unknown Lysichiton americanum Scirpus microcarpus, Athyrium filix-femina
Four	Valley bottom (riparian, seral and old growth areas) Sidehills (?)	Lonicera involucrata, Rubus spp., Oplopanax horridus, Sambucus racemosa, Ribes bracteosum, Vaccinium spp.
Five	Valley bottom Riparian-spawning channels and and seral areas	Chum salmon Pink Salmon, Viburnum edule, Cornus sericea, Osmorhiza chilensis
Six	Valley bottom Floodplain	Fresh and decomposing salmon
Seven	Valley bottom and unknown	Lysichiton americanum and ?

Table 14. Den site characteristics for Kimsquit grizzly bears from 1982/83 and 1983/84 winter.

Bear	Year	Location/ drainage	Aspect (degrees)	Elevation (m)	Habitat	Ground visitation	Comments
Jason	1982/83	Lower King George Creek	210	450	70% CWH131G 30% CWH135G	No	Merchantable Timber?
Stanley	1982/83	Lower Dean	205	795		No	Rocky area
Sandy	1982/83	Salient Creek	195	1245	MHd2G	Yes	See Appendix C this rep.
Marsha	1982/83	Pollard Creek	140	850	80% CWH132G 20% CWH131G	No	Very close to Mountain Hemlock Zone
Shelly	1982/83	Hoam Creek	40	775	80% MHd1G 20% MHd5C	No	
Unknown	1982/83	Upper Kimsquit River	55	640	CWH138B	Yes	See Appendix D Hamilton 1983
Marsha	1983/84	Cornice Creek	95	825	MHd1A	No	
Shelly	1983/84	Hoam Creek	55	610	80% MHd1G 20% MHd5C	No	Very close to 1982 Den
Sonny	1983/84	Kimsquit Lake	135	640	CWH132F	No	
Andy	1983/84	Kimsquit Lake	140	580	CWH132F	No	Very near Sonny's den
Louise	1983/84	Crawford Peak	190	915	CWH138C	No	

WORKING PLAN - YEAR 3 - 1984

RESEARCH TOPICS

Seasonal Habitat Use Model

In 1983, no data were collected for bear season one (emergence to valley floor leaf flush) and only limited data for season two (valley floor leaf flush to avalanche chute green-up). Collecting data for these early seasons, therefore, will be a priority in 1984. Data collection will start in early April and will parallel that of 1983.

Effects of Forest Practices

Coastal watersheds are typified by narrow floodplains bordered by precipitous mountains. These floodplains have the highest timber values and thus high logging potential. As well, most grizzly bear activities occur in these areas. Research in 1984 will focus on the effects of logging disturbance and habitat alteration on grizzly bear activty.

1. **Model of current understanding**

   a. Some area-concentrated food sources such as skunk cabbage, cranberry, dogwood, and salmon are of limited distribution in the Kimsquit.

   b. Food sources are critical to maintaining carrying capacity for grizzly bears in the Kimsquit.

   c. In these areas, grizzly bears appear to be more tolerant of each other and probably to disturbance.

   d. Security cover (visual screens) adjacent to these areas appears to be important for some sex/age classes of grizzly bears.

   e. Thermal cover and cover from precipitation adjacent to these areas may be important for resting sites.

   f. Denial of grizzly access to these areas through disturbance or habitat alteration will result in a decrease in the carrying capacity of the watershed for grizzly bears.

2. **Hypotheses**

The general null hypothesis is that logging activities will not affect grizzlies use of habitat nor their activity patterns. To assess this general prediction, we plan to test three specific, component hypotheses that address size and centres of home ranges, activity patterns, and the effect of visual screens on these patterns. These tests will be based on data collected from the two intensively studied adult females because their home ranges include the floodplain where logging is occurring, and because

we can collect the required quantity and quality of data to test the hypotheses.

Hypothesis 1: Logging activities will not increase the size of seasonal home ranges or shift their harmonic mean centres.

To test this hypothesis, we will determine the following:

- the zone of logging activity (z.l.a.) using a sound level meter (the zone will extend to the limit of discernible logging noise).

- the percentage of each grizzly bear's seasonal home range that is within the z.l.a.

- the frequency of truck traffic along the main haul.

A minimum of 40 fixes/season/bear will be collected, which means a minimum of two fixes/day/bear by ground telemetry and one fix/week/bear by aircraft. Data analysis will be with HOME and CENTRE programs.

The hypothesis will be rejected if:

- the seasonal centres of activity have shifted outside of the z.l.a. between years for either bear;

- there is a 50% reduction in the number of relocations within the z.l.a. during logging between years;

- there is a 50% increase in the average minimum distance between consecutive locations from within the z.l.a. to outside the z.l.a.;

- seasonal home range sizes increase by 50% of the extent of the z.l.a. with the home range;

- shifts occur in the seasonal centres of activity that are the same width as the z.l.a.;

- there is a 50% increase in the average minimum distance to human activity.

Hypothesis 2: Within the zone of logging activity, there will be no difference in activity patterns of grizzlies during and not during disturbance.

A minimum of two fixes/bear/day with and without logging activity will be taken with ground telemetry. Ground relocations will be followed by site investigations to determine grizzly bear activity. Interpretations will be made by comparing seasonal grizzly bear activity with and without logging activity.

The hypothesis will be rejected if:

- there is a 50% change in the number of activities within the z.l.a.;
- there is a 25% change in the proportions of activities (bedding, feeding, travel) within the z.l.a. between years;
- there is a 50% difference in the number of activities within the z.l.a. with or without logging;
- if there is a 25% change in the proportions of activities within the z.l.a. with or without logging.

Hypothesis 3: Within the z.l.a., there will be no difference in activity patterns during disturbance among areas with different screen types and between areas with or without visual screens.

A minimum of two fixes/bear/day will be taken by telemetry during logging. Site investigations will follow ground relocations. At each site within the z.l.a., measurements will be taken of: noise level, distance to logging activity, cover value along axis to human activity, and cover type (topography, vegetation, other). A general description of the area will also be included. Area-concentrated food sources will be mapped and identified as being within or outside the z.l.a., noise level, distance to logging, and screens (type, if present). Data interpretation will be based on comparisons of activities between sites with different logging activity noises and between sites with the same noise levels and with and without visual screens.

The hypothesis will be rejected if:

- there is a difference in the number and proportion of grizzly bear activities within the z.l.a. at different noise levels;
- grizzly bears use areas within the z.l.a. with visual screens and avoid other similar areas with the same noise levels but no visual screens.

3. Confounding factors

Grizzly bear movement may be different between years because of variations in annual plant productivity. This factor will be addressed through productivity information collected during site investigations.

Grizzly bear movement may be directed by social interactions. Untagged grizzly bears known to be in the watershed will be trapped opportunistically when there is no chance of capturing the collared adult females.

Grizzly bears may adapt to disturbance from logging. Adaption will be checked by partitioning the seasons and determining differences in grizzly bear responses over time.

Experimental Habitat Manipulation

Areas for habitat manipulation in 1985 will be identified. These areas will be discussed with Federal Fisheries (Bella Coola) and presented to the Ministry of Forests District Office by August 1. Areas slated for manipulation in 1985 will be sampled in 1984 as time, money, and manpower permit. Emphasis will be placed in conducting telemetry and subsequent site investigations in these areas when collared grizzly bears are present. As well, timber values will be determined and habitat classification confirmed.

Effort will be made to increase the sample size of collared grizzly bears in the intensive study area and areas proposed for manipulation. Trapping will start when untagged grizzly bears are known to be in the area and when the movements of our adult females will not bring them into contact with the traps. Trapping will not likely run for more than three days at any one time.

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APPENDIX A : SITE INVESTIGATION FORM

1. Date
2. Surveyors
3. Site #
4. Coordinates
5. Date of relocation
6. Bear #
7. Plot size
8. Habitat type
   cover value
9. Elevation
10. Slope
11. Aspect
12. Moisture regime
13. Nutrient regime
14. Humus form
15. Surface texture
16. Soil type
17. Season
18. Trafficability
19. Activity — 1=bed 2=feed 3=mark tree 4=mark trail 5=travel 6=_____
20. Distance to opening
    habitat type
21. Distance to water
    salmon abundance — 1=none 2=low 3=med 4=high
    salmon availability — 1=none 2=low 3=med 4=high
22. Distance to cover
    habitat type
    cover value
22. Predominant associate cover
    distance to
    habitat type
    cover value
23. Distance to human activity
    activity type
    current use
24. Surface substrate
    humus
    decaying wood
    bedrock
    rock
    mineral soil
    water
25. Film number
26. Picture numbers

Site Diagram

ACTIVITY DETAILS:

COMMENTS:

VERIFICATION BY:

Strata coverage

Tree _____ Shrub _____ _____ Herb _____ Moss & lichens _____

Species list	Stratum	% cover	distribution	vigor	phenology vegetative	phenology generative	berry abundance % stem bearing	berry abundance average abundance

Appendix B-1. Capture and immobilization data for black bears, 1984.

Name	Age (yr.)	Sex	Date	Time first observed	Capture method	Capture location	Bait	Est. wt. (kg)	Needle length (cm)	Time of needle	Vol. (cc)	Site of needle	Method
Cubby	4	M	May 05	0925	Cubby	Swamp	Meat scraps, beaver	90	2.5	0933	3	Left thigh	
Spaz	5	M	May 07	0932	Cubby	Swamp	Fish, meat scraps	90	2.5	0944	3	Right thigh	
Toby	5	M	May 08	0915	Cubby	Salient	Various	90	3.8	0932	3	Right flank	
Morris	5	M	May 09	0910	Cubby	Dogwood	Beaver	70	2.5	0920	2.5	Right thigh	
Luther	9	M	May 09	1750	Cubby	Trapper	Beaver	135		1801	3.5	Right thigh	
Charlie	6	M	May 11	1740	Trail	Estuary	Various	90		1742	3	Left rear thigh	
Ernie	5	M	May 12	0935	Cubby	Slide 1	Various	55	2.5	0950	2	Right rear thigh	
Tenee	3	F	May 15	1005	Cubby	Dolly	Herring meal	55	2.5	1016	2	Right thigh	
Tsuga	9	M	May 17	1030	Cubby	Swamp	Various	125		1040 1103	3 1.5	Left thigh Right shoulder	 Hand

Appendix B-2. Physical description of captured black bears, 1984.

Name	Neck Circ (mm)[a]	Tooth Rmvd	Tooth wear	Lip Tatt. No.	Lip Tatt. Loc'n	Zygo (mm)	Cbl (mm)	Nose to tail (mm)	Shld ht (mm)	Hart Girt (mm)	Max girt in (mm)	Max girt out (mm)	Frnt toe to sole (mm)	Front pad width (mm)	Rear toe to sole (mm)	Rear pad width (mm)	Colour	Comments
Cubby	452	LRPM1	Min	35		235	325	1155	795	755	835	805	109	107	196	104	Black	Excellent condition.
Spaz		LRPM1								755							Black-white chest V	Brown muzzle, long induction, held by three toes.
Toby	480	LLP1	Mod	37	Upper right	195	350	1650	910	830	1015	950	108	123	203	125	Light sandy except feet & forearms	Some convulsions.
Morris	510	LLMP1	Min	39	Upper right	195	325	1515	770	790	915	870	98	110	175	104	Black-black muzzle	Scar on face, rubbed on flanks
Luther	680	LLPM1	Mod	40	Upper left	230	330	1760	905	1070	1210	1190	119	125	220	120	Black-white chest	Good condition, two fresh wounds on head
Charlie	480	LLPM1	Min	42	Upper right	180	298	1520	780	740	992	960	106	109	182	111	Black-white chest V	Pelt in excellent condition, but bear thin
Ernie	510	LLPM1	Min	43	Upper right	209	316	1520	770	780	884	860	98	105	180	100	Black-brown muzzle	Held by rear foot - excellent condition, 1 scar above left eye
Tense	360	LLPml	Min	45	Upper left	164	273	1314	684	670	740	700	88	85	159	83	Black	Other large bear in vicinity - excellent condition
Touge	610	LLPM1	Mod			245	329	1630	836	1005	1025	1010	124	118	185	107	Black	Recapture-pelt excellent. agressive bear

[a] Legend for column headings:

Neck circ - neck circumference (maximum)
Tth rmvd - tooth removed
Tth wear - tooth wear (maximum, moderate, or minimal)
Zygo -zygomatic width (maximum width across cheek bones)
Cbl - condobasal length (maximum skull length)
Nose to tail - total length nose to tail
Shld Ht - shoulder height
Hart girt - heart girth
Max girt in - maximum girth, breath in
Max girt out - maximum girth, breath out
Frnt (rear) toe to sole - maximum length of foot, toe to sole
Frnt (rear) pad width - maximum length across pad of foot
Colour - brief description of colouration

Appendix B-3. Capture and immobilization data for grizzly bears, 1984.

NAME	Age	Sex	Date	Time First Observed	Capture Method	Location of Capture	Bait	Est. Wt. (kg)	Needle Length (cm)	Time of Needle	Vol. (cc)	Site	Method
Caesar	17	M	May 08	1100	Trail	Siah		320	2.5	1144	5	Left thigh	Dist. inject. gun
										1318	3	Right shoulder	Dist. inject. gun
Stanley	3	M	May 11	1010	Trail	Dean	Various	115	2.5	1017	5	Upper right thigh	Dist. inject. gun
Sonny	13	M	May 13	1115	Trail	Sedge	Various	160	2.5	1128	4	Left thigh	Dist. inject. gun
											2	Left shoulder	Hand
Caesar	17	M	May 13	0940	Cubby	Eagle	Beaver	320	2.5	(0000)	5	Right thigh	Dist. inject. gun[a]
										0950	3		
										1009	5	Right thigh	Dist. inject. gun
										0020			
Jenny	37	F	May 16	1005	Cubby	Dolly	Fish/Meal Beaver	50	2.5	1019	3	Left thigh	Dist. inject. gun
Amos	3	M	May 16	1145	Trail	Lake Trail #1	Various	125	2.5	1202	4	Right thigh	Dist. inject. gun
Andy	3	M	May 18	1205	Trail	Lake Trial #4	Various	125	2.5	1217	4	Left hind low	Dist. inject. gun
Louise	11	F	May 19	1045	Aerial	Jason's slide		140	3.8	1055	5	Right rump	Dist. inject. gun

[a] Recapture - note drug dosage required.

Appendix B-4. Physical measurements for the captured grizzly bears, 1984.

Name	Neck Circ	Tth Rmvd	Tth Bear	Lip Tatt. No.	Lip Tatt. Loc'n	Zygo	Chl	Nose to tail	Shld ht	Hart Girt	Man girt in	Man girt out	Frnt toe to sole	Frnt pad width	Rear toe to sole	Rear Pad width	Colour	Comments
Caesar	900	LLRP1	Man	38	Right upper	300	460	2300	1135	1700			160	200	260	190	Dark brown some blonde	Oldest, largest adult male captured -abrasion from cable-broken canine
Stanley	600	LLPW1	Min	41	Upper left	220	390	1885	975	1070	1130	1100	125	140	210	158	Light sandy except feet & forearms	Rubbing from last year's collar evident - good condition
Sonny	740	LLPW1	Med	44	Upper right	280	380	2225	1105	1200	1305	1240	134	150	205	142	Light brown dark forearms	Right thigh-severe wound-infected not from capture "small" bear
Jenny	380	LLPW1	Min	11	Upper left	140	160	1340	750	680	720	690	96	114	166	98	Blonde	Tooth age suspect. Recapture-excellent condition-good recovery
Anne	520	LLPW1 ULPW1	Min	46	Upper right	200	350	1650	910	830	1015	950	108	123	203	125	Light sandy except feet & forearms	Rubbed-accompanied by bear No.41-collar fit loose.
Andy	550	LLPW1 ULPW1 LRPW1	Min	41	Upper right	210	360	1610	890	910	1196	1130	115	130	120	210	Sandy except feet and forearms	Rubbed-accompanied by bear No.46-collar fit loose.
Louise	620	ULPW	Med	48	Upper right	240	405										Almost red-brown	Ran with large male at time of capture.

APPENDIX C: Den Site Characteristics, of Bear No. 05, Winter 1982/83

Location: middle Salient Creek
Aspect: 195° (SW)

Elevation: 1245 m
Slope: 70%
Subzone: MHdp

Description

Bear 05 (Sandy), a lone adult female, was located in her den March 3 and April 11, 1983. Her previous location on October 12 was in a different watershed and therefore the date of den entrance was unknown. She left the site some time between April 11 and 30.

The den, excavated under a large mountain hemlock tree, was situated on a steep, south-facing rocky slope of Salient Creek. Ground measurements were taken on June 13.

The site was very close to the upper elevational limit of the Mountain Hemlock zone (Clement 1984) and was classified as MHd2G. The following is a brief description of the vegetative cover in the vicinity:

	Cover (%)
Tsuga mertensiana	70
Abies amabilis	10
Abies lasiocarpa	5
Alnus sinuata	5
Vaccinium spp.	5
Menziesia ferruginea	40
Veratrum viride	1

Unlike the den measured in 1982, Sandy's den had required extensive excavation of tree roots (up to 10 cm in diameter), rocks, and soil. A number of the lower limbs of the tree were also broken off. The main chamber was shaped like two saucers facing each other with the following dimensions:

Maximum length	167 cm
Maximum width	143 cm
Maximum height	99 cm

The single south-facing entrance was very small (64 by 58 cm) and was partly protected by some overhanging branches of the tree. A large rock formed the base of the chamber while the root mass supported and formed the ceiling.

A very large volume of bedding material was at the site, both inside the chamber and on the "porch." The chamber bedding was mainly mountain hemlock boughs but there were some branches of Menziesia ferruginea and Abies lasiocarpa. When removed and compressed, it formed a pile 130 cm long, 100 cm wide, and 30 cm deep. A large volume of boughs (550 cm by 300 cm) was piled in front of the den. These were of different ages suggesting that the bear left the chamber but remained in the vicinity of the den for some time during mid-April. Well-defined trails radiating from the den were assumed to have been used during bough collection. A fecal plug was located near this material. Histological analyses of some of the material found in the plug (including some bone chips) are under way.